Evaluate the following (1to 23) integers:

1. i) $\int 2x(x^2+1)dx$

Let $x^2+1=t$

$2x=\frac{dt}{dx}$

Let $I=\int 2x(x^2+1)dx$

$=\int t\,dt=\frac{t^2}{2}+c$

$$I=\frac{(x^2+1)}{2}+c$$

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ii) $\int \frac{\sin\sqrt{x}}{\sqrt{x}}\,dx$

let $\sqrt{x} = t$

$\frac{1}{2\sqrt{x}} = \frac{dt}{dx}$

$\frac{1}{\sqrt{x}}\,dx = 2\,dt$

$I = \int \frac{\sin\sqrt{x}}{\sqrt{x}}\,dx$

$= 2\int \sin t\,dt$

$= -2\cos t + c$

$= -2\cos t + c$

$\boxed{I = -2\cos\sqrt{x} + c}$

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iii) $\int \frac{\sec^2\sqrt{x}}{\sqrt{x}}\,dx$

Put $\sqrt{x} = t$

$\frac{1}{2\sqrt{x}}\,dx = dt$

$\frac{1}{\sqrt{x}}\,dx = 2\,dt$

$I = 2\int \sec^2 t\,dt$

$= 2\tan t + c$

$\boxed{I = 2\tan\sqrt{x} + c}$

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7.i) $\int \frac{e^{tan^{-1}x}}{1+x^2}\,dx$

$\tan^{-1}x = t$

$\frac{1}{1+x^2}\,dx = dt$

$$I = \int \frac{e^{\tan^{-1}x}}{1+x^2}\,dx$$

$$= \int e^t\,dt$$

$$= e^t + c$$

$$I = e^{\tan^{-1}x} + c$$

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ii) $\int \frac{\sin(2\tan^{-1}x)}{1+x^2}\,dx$

Let $2\tan^{-1}x = t$

$2 \times \frac{1}{1+x^2}\,dx = dt$

$\frac{1}{1+x^2}\,dx = \frac{dt}{2}$

$I = \int \sin t \frac{dt}{2}$

$= \frac{1}{2}\int \sin t\, dt$

$= \frac{-1}{2}\cos t + c$

$$= -\frac{1}{2}\cos(2\tan^{-1}x) + c$$

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